Part I — Administrative

CHAPTER 1
ADMINISTRATION

R101.1 Title. These provisions shall be known as the *Residential Code for One- and Two-Family Dwellings* of the City of Houston, and shall be cited as such and will be referred to herein as "this code."

The Building Code of the City of Houston, Texas, collectively includes this volume and certain other codes, pamphlets, specifications and documents that are adopted in or by reference through the adopting ordinance, which appears in the preamble of the City of Houston Building Code–General Provisions, Volume 1.

R101.2 Scope. The provisions of the *International Residential Code for One- and Two-Family Dwellings* shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories in height with a separate means of egress and their accessory structures. Buildings that exceed three stories in height shall comply with the City of Houston Building Code–General Provisions, Electrical Code of the City of Houston, City of Houston Mechanical Code, and City of Houston Plumbing Code. One- and two-family dwellings and townhouses shall be classified as Group R Division 3 Occupancies and accessory structures shall be classified as Group U Occupancies.

R102.5 Appendices. Provisions in the appendices shall not apply unless specifically referenced in ~~the adopting ordinance.~~ this section. Appendix A, Appendix B, Appendix C, Appendix H and Appendix L are hereby adopted and made part of this code.

Table of Houston Amendments to the 2000 International Residential Code for One- and Two-Family Dwellings

R102.7 Existing structures. The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is ~~specifically covered in this code, the *International Property Maintenance Code* or the *International Fire Code*, or as is~~ deemed necessary by the building official for the general safety and welfare of the occupants and the public.

R102.8 Energy conservation. Part IV–Energy Conservation (Chapter 11) of this code is not adopted.

102.9 Special piping and storage systems. Chapter 22 Special Piping and Storage Systems of this code is not adopted. See the Houston Fire Code regarding flammable and combustible liquids.

R102.10 Electrical Code. Part VIII–Electrical (Chapters 33 - 42) of this code is not adopted. All electrical work and licensing shall comply with the Electrical Code of the City of Houston. All references made to *ICC Electrical Code* are to be considered as made to the *Electrical Code of the City of Houston*.

R102.11 Mechanical Code. The licensing of air-conditioning contractors shall be as required by the City of Houston Mechanical Code and applicable State laws.

R102.12 Plumbing Code. The licensing of plumbers and plumbing contractors shall be as required in the City of Houston Plumbing Code and applicable State laws.

SECTION R103

~~DEPARTMENT OF BUILDING SAFETY~~

CODE ENFORCEMENT

R103.1 Creation of enforcement agency. The ~~department of building safety~~ Code Enforcement Division of the Planning and Development Department is hereby created and the official in charge

thereof shall be known as the building official.

R104.8 Liability. ~~The building official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties. Any suit instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representative of the jurisdiction until the final termination of the proceedings. The building official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.~~ Except as otherwise provided by law, the building official shall not personally be liable in damages for any act or omission arising out of any official action taken to implement and enforce the provisions of this code. Additionally, except as otherwise provided by law, the building official shall not personally be liable in damages for any action or omission taken in the course and scope of employment. Where and to the extent consistent with the provisions of Article X of Chapter 2 of the City Code, the jurisdiction shall provide legal representation and indemnification for any suit brought against the building official because of acts or omissions performed in the enforcement of this code.

This code shall not be construed to relieve from or lessen the responsibility of any person owning, operating or controlling any building or structure for any damages to persons or property caused by defects, nor shall the code enforcement agency or its parent jurisdiction be held as assuming any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

~~**R104.10.1 Areas prone to flooding.** The building official shall not grant modifications to any provision related to areas prone to flooding as established by Table R301.2(1) without the~~

~~granting of a variance to such provisions by the board of appeals.~~

R104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. ~~Compliance with the specific performance-based provisions of the International Code Council (ICC) codes in lieu of specific requirements of this code shall also be permitted as an alternate.~~

R104.12 Stop orders. The building official may order work stopped hereunder in the same manner provided in Section 104.2.4 of the City of Houston Building Code–General Provisions.

R105.2 Work exempt from permit. Permits shall not be required for the following. Exemption from the permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction.

Building:

1. One-story detached accessory structures, provided the floor area does not exceed ~~200~~ 120 square feet ~~(18.58 m)~~ (11.15 m^2).
2. Fences not over ~~6~~ 8 feet ~~(1829 mm)~~ (2438 mm) high that are not constructed of masonry or concrete.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon grade if the capacity does not exceed 5,000 gallons (18

927 L) and the ratio of height to diameter or width does not exceed 2 to 1.

5. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade and not over any basement or story below.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools accessory to a one or two family dwelling in which the walls are entirely above grade and if the capacity does not exceed 5,000 gallons (18 927 L). ~~that are less than 24 inches (610 mm) deep.~~
8. Swings and other playground equipment accessory to a one- or two-family dwelling.
9. Window awnings supported by an exterior wall.

Electrical:

Repairs and maintenance: A permit shall not be required for ~~minor repair work, including~~ the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying appliances.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation appliances.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or

that are actuated by motors of 1 horsepower (746 W) or less.

Plumbing:

The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a permit shall be obtained and inspection made as provided in this code.

The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

~~**R105.3.1.1 Substantially improved or substantially damaged existing buildings and structures.** For applications for reconstruction, rehabilitation, addition, or other improvement of existing buildings or structures located in an area prone to flooding as established by Table R301.2(1), the building official shall examine or cause to be examined the construction documents and shall prepare a finding with regard to the value of the proposed work. For buildings that have sustained damage of any origin, the value of the proposed work shall include the cost to repair the building or structure to its predamage condition. If the building official finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure, the finding shall be provided to the board of appeals for a determination of substantial improvement or substantial damage. Applications determined by the board of appeals to constitute substantial improvement or substantial damage shall meet the requirements of Section R327.~~

R105.5 Expiration. ~~Every permit issued shall become invalid unless the work authorized by such permit is commenced within 180 days after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not~~

~~more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.~~ For purposes of this subsection, the determination whether work has commenced under a permit or whether work has been abandoned under a permit shall be based upon whether the permit holder requests an inspection of the work performed under the permit by the building official. If work is not commenced under a permit within 180 days of the date of issuance or is abandoned at any time for a period of 180 consecutive days, the permit shall lapse. An elapsed permit shall expire the 180th day following the date that the permit lapsed. The permit holder may obtain reactivation of the permit by:

1. Requesting reactivation of the permit by the building official; and
2. Requesting an inspection of work performed under the permit by the building official.

A permit may only be reactivated one time, and it shall expire if the work is again abandoned for a period of 180 consecutive days. In order to recommence work under an expired permit, the permit holder shall pay the full permit fee applicable and submit plans that comply with this code for the previously uninspected portion of the work.

Exception: The building official may upon request perform a final inspection of work for which the permit has expired or reactivate a permit for the purpose of issuing a certificate of compliance.

R105.6 Suspension or revocation. The building official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or regulation or any of the provisions of this code. Prior to taking such action the building official shall provide notice of a right to a hearing on the matter pursuant to Section 104.2.11 of the City of Houston Building Code–General Provisions.

~~**R106.1.3 Information for construction in areas prone to flooding.** For buildings and structures in flood hazard areas as established by Table R301.2(1), construction documents shall~~

~~include:~~

1. ~~Delineation of flood hazard areas, floodway boundaries, and flood zones, and the design flood elevation, as appropriate;~~
2. ~~The elevation of the proposed lowest floor, including basement; in areas of shallow flooding (AO zones), the height of the proposed lowest floor, including basement, above the highest adjacent grade; and~~
3. ~~If design flood elevations are not included on the community's Flood Insurance Rate Map (FIRM), the building official and the applicant shall obtain and reasonably utilize any design flood elevation and floodway data available from other sources.~~

R108.2 Schedule of permit fees. On buildings, structures, electrical, gas, mechanical, and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the schedule as established ~~by the applicable governing authority~~ in Section 110 of the City of Houston Building Code–General Provisions.

R108.5 Refunds. The building official ~~is authorized to establish a refund policy~~. may authorize refunding of any fee paid hereunder which was erroneously paid or collected due to an error by one or more city employees. This provision shall not be applicable if the error occurred because of incorrect information provided by the applicant.

The building official may authorize the refunding of not more than 90 percent of the amount in excess of $25.00 of the permit fee paid when no work has been done under a permit issued in accordance with this code. If work has been done under the permit, no refund may be authorized.

The building official shall not authorize refunding of any fee paid except on written application filed by the original permittee not later than 180 days after the date of fee payment.

R109.1.3 Floodplain inspections. For construction permitted in areas prone to flooding inspections shall be in accordance with Chapter 19 of the City Code. ~~as established by Table~~

~~R301.2(1), upon placement of the lowest floor, including basement, and prior to further vertical construction, the building official shall require submission of a certification, prepared by a registered professional engineer or land surveyor, of the elevation of the lowest floor, including basement, required in Section R327.~~

SECTION R110

CERTIFICATE OF ~~OCCUPANCY~~ COMPLIANCE

R110.1 Use and occupancy. When requested by the applicant, the building official is authorized to issue a certificate of compliance after all the final inspections have been approved. ~~No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid.~~

R110.2 Change in use. Changes in the character or use of an existing structure shall not be made except as specified in Sections 3405 ~~and 3406 of the *International Building Code*~~ of the City of Houston Building Code–General Provisions.

~~**R110.3 Certificate issued.** After the building official inspects the building or structure and finds no violations of the provisions of this code or other laws that are enforced by the department of building safety, the building official shall issue a certificate of occupancy which shall contain the following:~~

~~1. The building permit number.~~
~~2. The address of the structure.~~
~~3. The name and address of the owner.~~
~~4. A description of that portion of the structure for which the certificate is issued.~~

~~5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code.~~

~~6. The name of the building official.~~

~~7. The edition of the code under which the permit was issued.~~

~~8. If an automatic sprinkler system is provided.~~

~~9. Any special stipulations and conditions of the building permit.~~

~~**R110.4 Temporary occupancy.** The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.~~

~~**R110.5 Revocation.** The building official shall, in writing, suspend or revoke a certificate of occupancy issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.~~

R112.1 General. ~~In order to~~ Except as provided below for mechanical and plumbing issues, the General Appeals Board shall, in accordance with the provisions of the City of Houston Building Code–General Provisions, hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code~~, there shall be and is hereby created a board of appeals. The building official shall be an ex officio member of said board but shall have no vote on any matter before the board. The board of appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official~~.

R112.2 Mechanical. The Air-conditioning Board shall, in accordance with the provisions of the City of Houston Mechanical Code, hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of Part V of this code. ~~**Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, or an equally good or better form of construction is proposed. The board shall have no authority to waive requirements of this code.~~

~~**R112.2.1 Determination of substantial improvement in areas prone to flooding.** When the building official provides a finding required in Section R105.3.1.1, the board of appeals shall determine whether the value of the proposed work constitutes a substantial improvement. A substantial improvement means any repair, reconstruction, rehabilitation, addition, or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. If the building or structure has sustained substantial damage, all repairs are considered substantial improvement regardless of the actual repair work performed. The term does not include:~~

~~1. Improvements of a building or structure required to correct existing health, sanitary or safety code violations identified by the building official and which are the minimum necessary to assure safe living conditions.~~

~~2. Any alteration of an historic building or structure provided that the alteration will not preclude the continued designation as an historic building or structure.~~

~~**R112.2.2 Criteria for issuance of a variance for areas prone to flooding.** A variance shall only be issued upon:~~

~~1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards in Section R327 inappropriate.~~

2. ~~A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.~~
3. ~~A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.~~
4. ~~A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.~~
5. ~~Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.~~

R112.3 Plumbing. The Plumbing Code Review Board shall, in accordance with the provisions of the City of Houston Plumbing Code, hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of Part VI and Part VII of this code. ~~**Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.~~

Part II — Definitions

CHAPTER 2

DEFINITIONS

BUILDING OFFICIAL. The ~~officer or other designated authority charged with the administration and enforcement of this code~~ director of planning and development, or the director's duly authorized representative.

CITY CODE. The Code of Ordinances, Houston, Texas.

CHAPTER 3

BUILDING PLANNING

R301.2.1.1 Design criteria. Construction in regions where the basic wind speeds from Figure R301.2(4) equal or exceed 110 miles per hour (177.1 km/h) shall be designed in accordance with one of the following:

1. American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM); or
2. Southern Building Code Congress International Standard for Hurricane Resistant Residential Construction (SSTD 10); or
3. Minimum Design Loads for Buildings and Other Structures (ASCE-7); or
4. Cold-formed steel construction shall be designed in accordance with the provisions of this code.
5. Appendix L - Conventional light frame wood construction for high wind areas.

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

ROOF SNOW LOAD	WIND	SEISMIC DESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM				WINTER DESIGN TEMP[g]	~~FLOOD HAZARDS[h]~~
	Speed[c] (mph)		Weathering[a]	Frost line depth[b]	Termite[c]	Decay[d]		
0	110	A	Negligible	6".	Very Heavy	Moderate to Severe	28° F.	

~~For SI: 1 pound per square foot = 0.0479 kN/m.0 2 , 1 mile per hour = 1.609 km/h.~~

~~a. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The weathering column shall be filled in with the weathering index (i.e., "negligible," "moderate" or "severe") for concrete as determined from the Weathering Probability Map [Figure R301.2(3)]. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.~~

~~b. The frost line depth may require deeper footings than indicated in Figure R403.1(1). The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.~~

~~c. The jurisdiction shall fill in this part of the table with "very heavy," "moderate to heavy," "slight to moderate," or "none to slight" in accordance with Figure R301.2(6) depending on whether there has been a history of local damage.~~

~~d. The jurisdiction shall fill in this part of the table with "moderate to severe," "slight to moderate," or "none to slight" in accordance with Figure R301.2(7) depending on whether there has been a history of local damage.~~

~~e. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(4)]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.~~

~~f. The outdoor design dry-bulb temperature shall be selected from the columns of 97 1/2-percent values for winter from Appendix D of the *International Plumbing Code*. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the building official.~~

~~g. The jurisdiction shall fill in this part of the table with the Seismic Design Category determined from Section R301.2.2.2.~~

~~h. The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction' sentry into the National Flood Insurance Program(date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the currently effective FIRM and FBFM, or other flood hazard map adopted by the community, as may be amended.~~

R302.1 Exterior walls. Exterior walls with a fire separation distance less than 3 feet (914 mm) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend beyond ~~the distance determined by the following two methods, whichever results in the lesser projections~~:

~~1. A~~ a point one-third the distance to the property line. ~~from an assumed vertical plane located where protected openings are required.~~

~~2. More than 12 inches (305 mm) into areas where openings are prohibited.~~

~~Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.~~

Exception: Tool and storage sheds, playhouses and similar structures exempted from permits by Section R105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.

R303.1 Habitable rooms. All habitable rooms shall be provided with aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by Section R310 and an approved mechanical ventilation system is provided capable of producing

0.35 air change per hour in the room or a whole-house mechanical ventilation system is ~~installed capable of~~ provided that will supply~~ing~~ outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.

2. The glazed areas need not be provided in rooms where Exception 1 above is satisfied and artificial light is provided capable of producing an average illumination of 6 footcandles (6.46 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.279 m^2), one-half of which must be openable.

Exception: The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm (23.6 L/s). ~~for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation.~~ Ventilation air from the space shall be exhausted directly to the outside.

R309.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1 3/8 inch (35 mm) in thickness, solid or honeycomb core steel doors not less than 1 3/8 inches (35 mm) thick, or 20-minute fire-rated doors all of which shall be self closing.

R309.1.1 Duct penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage. All duct joints shall be seamed and sealed.

R309.2 Separation required. The garage shall be separated from the residence and its attic area by not less than 1/2-inch (12.7 mm) gypsum board applied to the garage side. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than 1/2-inch (12.7 mm) gypsum board or equivalent. Attic disappearing stairs may be installed in the garage ceiling provided the exposed panel is not less than 3/8-inch thick fire retardant-treated plywood or covered with a minimum of 16 gage sheet metal.

R311.2 Type of lock or latch. All egress doors shall be readily openable from the side from which egress is to be made without ~~the use of a key or~~ special knowledge or effort. Key locking hardware may be used.

R321.2 Townhouses. Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302 for exterior walls.

Exception: A common 2-hour fire-resistance-rated wall is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. ~~Electrical installations shall be installed in accordance with Chapters 33 through 42.~~ Penetrations of electrical outlet boxes shall be in accordance with Section R321.3.

R321.2.2 Parapets. Parapets constructed in accordance with Section R321.2.3 shall be provided for townhouses as an extension of common exterior or walls in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm)above the lower roof surface.

   Exception: A parapet is not required in the two cases above when the roof is covered

with a minium class ~~C~~ B roof covering, and there is no roof opening within 5 feet of the wall. ~~the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of 5/8-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing for a distance of 4 feet (1219 mm) on each side of the wall or walls.~~

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall not have less than a 1-hour fire-resistive rating. The wall shall be rated for exposure from both sides.

SECTION R322

RESERVED

~~**MOISTURE VAPOR RETARDERS**~~

~~**R322.1 Moisture control.** In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.~~

~~**Exceptions:**~~

~~1. In construction where moisture or freezing will not damage the materials.~~
~~2. Where the framed cavity or space is ventilated to allow moisture to escape.~~
~~3. In counties identified with footnote a in Table N1101.2.~~

SECTION R324

RESERVED

~~**PROTECTION AGAINST TERMITES**~~

~~**R324.1 Subterranean termite control.** In areas favorable to termite damage as established by Table~~

~~R301.2(1), methods of protection shall be by chemical soil treatment, pressure preservatively treated wood in accordance with the AWPA standards listed in Section R323.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods.~~

~~**R324.2 Chemical soil treatment.** The concentration, rate of application and treatment method of the termiticide shall be consistent with and never less than the termiticide label.~~

~~**R324.3 Pressure preservatively treated and naturally resistant wood.** Heartwood of redwood and eastern red cedar shall be considered termite resistant. Pressure preservatively treated wood and naturally termite-resistant wood shall not be used as a physical barrier unless a barrier can be inspected for any termite shelter tubes around the inside and outside edges and joints of a barrier.~~

~~**R324.3.1 Field treatment.** Field cut ends, notches and drilled holes of pressure preservatively treated wood shall be retreated in the field in accordance with AWPA M4.~~

~~**R324.4 Foam plastic protection.** In areas where the probability of termite infestation is "very heavy" as indicated in Figure R301.2(6), extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be at least 6 inches (152 mm).~~

~~**Exceptions:**~~

1. ~~Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.~~
2. ~~When in addition to the requirements of R324.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.~~
3. ~~On the interior side of basement walls.~~

R325.1 Premises identification. Building numbering shall be provided in accordance with Article V of Chapter 10 of the City Code. ~~Approved numbers or addresses shall be provided for all new buildings in such a position as to be plainly visible and legible from the street or road fronting the property.~~

SECTION R326

RESERVED

~~ACCESSIBILITY~~

~~**R326.1 Scope.** Accessible dwelling units shall comply with Chapter 11 of the *International Building Code* as applicable.~~

R327.1 Flood-prone areas. See Chapter 19 of the City Code for requirements regarding construction in flood-prone areas. ~~**General.** All buildings and structures erected in areas prone to flooding as identified in Table R301.2(1) and classified as either flood hazard areas (including A Zones) or coastal high hazard areas (including V-Zones) shall be constructed and elevated as required by the provisions contained in this section.~~

~~**Exception:** All buildings and structures erected in identified floodways as established in Table R301.2(1) shall be designed and constructed as stipulated in the *International Building Code*.~~

~~**R327.1.1 Structural systems.** All structural systems of all buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation.~~

~~**R327.1.2 Flood-resistant construction.** All buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage.~~

~~**R327.1.3 Establishing the design flood elevation.** The design flood elevation shall be used to~~

define areas prone to flooding, and shall describe, at a minimum, the base flood elevation at the depth of peak elevation of flooding (including wave height) which has a 1 percent (100-year flood) or greater chance of being equaled or exceeded in any given year.

R327.1.4 Lowest floor. The lowest floor shall be the floor of the lowest enclosed area, including basement, but excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R327.1.5 Protection of mechanical and electrical systems. New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at or above the design flood elevation. Electrical wiring and outlets, switches, junction boxes and panels shall be elevated to or above the design flood elevation unless they conform to the provisions of the electrical part of this code for location of such items in wet locations. Duct systems shall not be installed below the design flood elevation

R327.1.6 Protection of water supply and sanitary sewage systems. New and replacement water supply systems shall be designed to minimize infiltration of flood waters into the systems in accordance with the plumbing provisions of this code. New and replacement sanitary sewage systems shall be designed to minimize infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with the plumbing provisions of this code and Chapter 3 of the *International Private Sewage Disposal Code*.

R327.1.7 Flood-resistant materials. Building materials used below the design flood elevation shall comply with the following:

1. All wood, including floor sheathing, shall be pressure preservatively treated in accordance with AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, P1, P2 and

P3 or decay-resistant heartwood or redwood, black locust, or cedars.

2. Materials and installation methods used for flooring and interior and exterior walls shall conform to the provisions of FEMA/FIA-TB-2.

R327.1.8 Manufactured housing. New or replacement manufactured housing shall be elevated in accordance with Section R327.2 and the anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured housing to be located in identified flood ways as established in Table R301.2(1) shall be designed and constructed in accordance with the applicable provisions in the *International Building Code*.

R327.1.9 As-built elevation certifications. A licensed land surveyor or registered design professional shall certify that the building or structure is in compliance with the elevation requirements of Section R327.2 or R327.3.

R327.2 Flood hazard areas (including A Zones). All areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. All buildings and structures erected in flood hazard areas shall be designed and constructed in accordance with Sections R327.2.1 through R327.2.3.

R327.2.1 Elevation requirements.

1. Buildings and structures shall have the lowest floors elevated to or above the design flood elevation.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM, or at least 2 feet (51 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides shall be elevated to or above the design

flood elevation.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R327.2.2.

R327.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings which shall meet the following criteria:
   - 2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.
   - 2.2. The total net area of all openings shall be at least 1 square inch for each square foot (275 mm for each square meter) of enclosed area.
   - 2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground level.
   - 2.4. Openings shall be at least 3 inches (76 mm) in diameter.
   - 2.5. Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.
   - 2.6. Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.

R327.2.3 Foundation design and construction. Foundation walls for all buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 4.

Exception: Unless designed in accordance with Section 404:

1. The unsupported height of 6 inches (152 mm) plain masonry walls shall be no greater than 3 feet (914 mm).

2. The unsupported height of 8 inches (203 mm) plain masonry walls shall be no greater than 4 feet (1219 mm).
3. The unsupported height of 8 inches (203 mm) reinforced masonry walls shall be no greater than 8 feet (2438 mm).

For the purpose of this exception, unsupported height is the distance from the finished grade of the under-floor space and the top of the wall.

R327.3 Coastal high hazard areas (including V Zones). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high velocity wave action or wave-induced erosion shall be designated as coastal high hazard areas. All buildings and structures erected in coastal high hazard areas shall be designed and constructed in accordance with Sections R327.3.1 through R327.3.5.

R327.3.1 Elevation requirements.

1. All buildings and structures erected within coastal high hazard areas shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is located at or above the design flood elevation.
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. The placement of fill beneath buildings and structures is prohibited.

Exception: Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R327.3.3 and R327.3.4.

R327.3.2 Foundations. All buildings and structures erected in coastal high hazard areas shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. Piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral

and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section R327.3.5. Mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions.

R327.3.3 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Are constructed with insect screening or open lattice.
2. Designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 pounds per square foot (0.48 kN/m^2) and no more than 20 pounds per square foot (0.96 kN/m^2); or
3. Where wind loading values of this code exceed 20 pounds per square foot (0.96 kN/m^2), a registered design professional shall certify the following:
    3.1. Collapse of walls and partitions below the design flood elevation shall result from a water load less than that which would occur during the design flood.
    3.2. The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.

~~**R327.3.4 Enclosed areas below design flood elevation.** Enclosed areas below the design flood elevation shall be used solely for parking of vehicles, building access or storage.~~

~~**R327.3.5 Design certificate.** A registered design professional shall certify that the design and methods of construction to be used meet the applicable criteria of this section.~~

CHAPTER 4

FOUNDATIONS

R401.1 Application. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. Wood foundations shall be designed and installed in accordance with AF&PA Report No. 7.

Exceptions:

1. The provisions of this chapter shall be permitted to be used for wood foundations only in the following situations:
   1.1. In buildings that have no more than two floors and a roof.
   1.2. When no dimension in a basement room or crawl space area exceeds the smaller of either the building width or length.
2. In addition to the provisions of this chapter, the design and construction of foundations in areas prone to flooding as established by Table R301.2(1) shall meet the provisions of Section R327.

Wood foundations in Seismic Design Categories D_1 and D_2 shall be designed in accordance with accepted engineering practice.

TABLE 403.1
MINIMUM WIDTH OF CONCRETE OR MASONRY FOOTINGS (INCHES)[a]

	LOAD-BEARING VALUE OF SOIL (psf)					
	1,500	2,000	2,500	3,000	3,500	≥4,000
Convention light-frame construction						
1-story	16 12	12	10	8 12	7	6 12
2-story	19 15	15 12	12	10 12	8	7 12
3-story	22 23	17	14	11 12	10	9 12
4-inch brick veneer light frame or 8-inch hollow concrete masonry						
1-story	19 12	15 12	12	10 12	8	7 12

Table of Houston Amendments to the 2000 International Residential Code for One- and Two-Family Dwellings

2-story	~~25~~ 21	~~19~~ 16	~~15~~	~~13~~ 12	~~11~~	~~10~~ 12
3-story	~~31~~ 32	~~23~~ 24	~~19~~	16	~~13~~	12
8-inch solid or fully grouted masonry						
1-story	~~22~~ 16	~~17~~ 12	~~13~~	~~11~~ 12	~~10~~	~~9~~ 12
2-story	~~31~~ 29	~~23~~ 21	~~19~~	~~16~~ 14	~~15~~	12
3-story	~~40~~ 42	~~30~~ 32	~~24~~	~~20~~ 21	~~17~~	~~15~~ 16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m²

a. Where minimum footing width is 12 inches a single width of solid or fully grouted 12-inch nominal concrete masonry units is permitted to be used.

R403.1.9 Optional–Foundations for additions to conventional construction. A foundation for an addition to conventional construction or for a Group R3 or U occupancy that: 1) is classified as exempt by Section 20 of the Texas Engineering Practice Act; and 2) meets or exceeds the specifications contained in Figure R403.1.9 shall be considered to comply with all requirements of this code. Neither an engineer's seal nor a soils report is required.

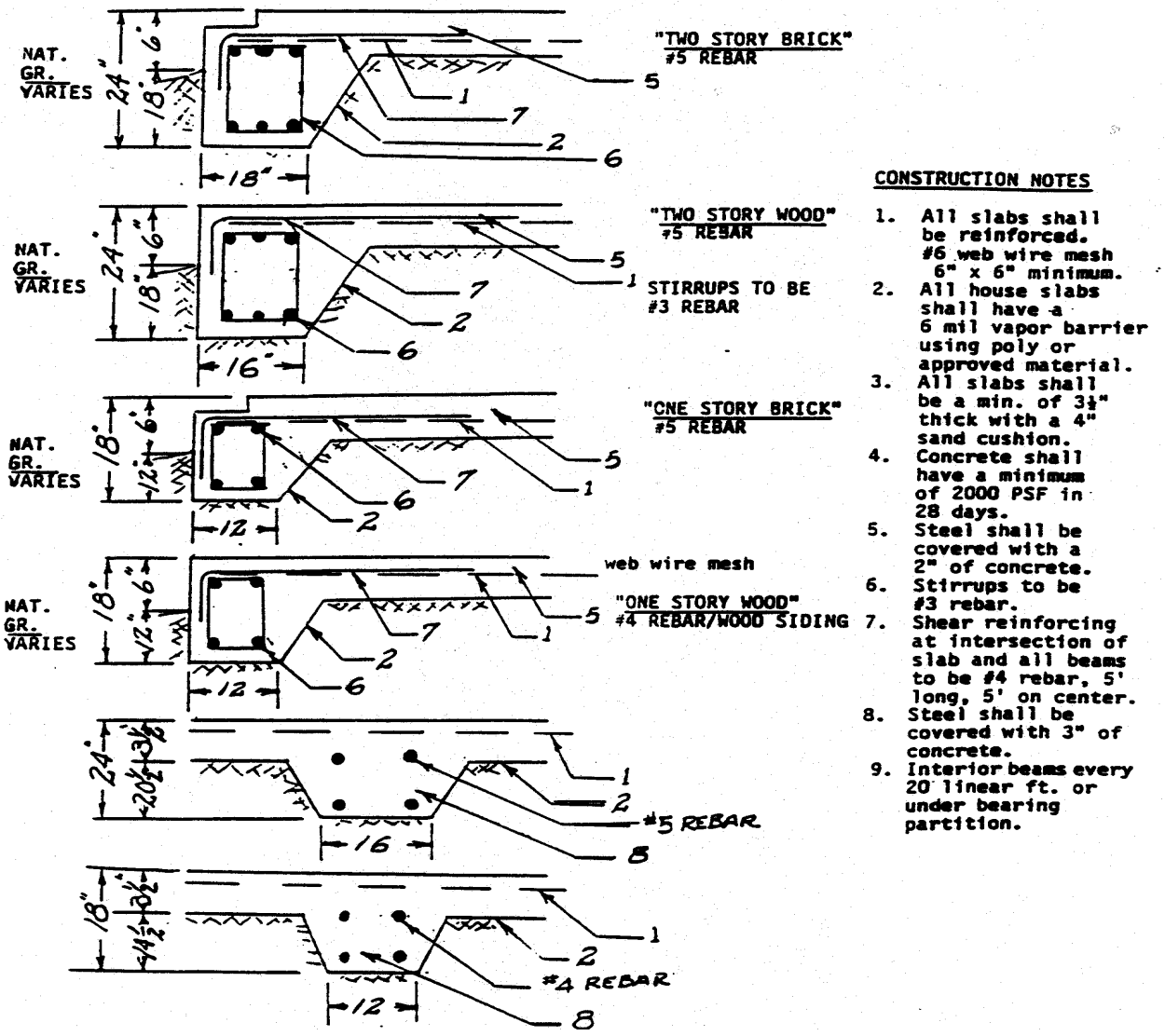

FIGURE R403.1.9
FOUNDATIONS FOR ADDITIONS

R405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains with perforated pipe or other approved systems or

materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1 foot (305 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tile or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (153 mm) of the same material.

CHAPTER 5

FLOORS

R502.3.3 Floor cantilevers. Floor cantilever spans shall not exceed the nominal depth of the wood floor joist. Floor cantilevers constructed in accordance with Table R502.3.3 shall be permitted when supporting a light-frame bearing wall and roof only. The ratio of backspan to cantilever span shall be at least 3 to 1.

TABLE R502.3.3
CANTILEVER SPANS FOR FLOOR JOISTS
SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLY [a, b, c, f, g, h]
(Floor Live Load ≤20 psf)

MEMBER AND SPACING	MAXIMUM CANTILEVER SPAN (UPLIFT FORCE AT BACKSPAN SUPPORT IN LBS.)[d, e]											
	GROUND SNOW LOAD											
	≤20 psf			30 psf			50 psf			70 psf		
	Roof Width			Roof Width			Roof Width			Roof Width		
	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft
2 x 8 @ 12"	20" (177)	15" (227)		18" (209)								
2 x 10 @ 16"	29" (228)	21" (297)	16" (364)	26" (271)	18" (354)		20" (375)					
2 x 10 @ 12"	36" (166)	26" (219)	20" (270)	34" (198)	22" (263)	16" (324)	26" (277)			19" (356)		
2 x 12 @ 16"		32" (287)	25" (356)	36" (263)	29" (345)	21" (428)	29" (367)	20" (484)		23" (471)		
2 x 12 @ 12"		42" (209)	31" (263)		37" (253)	27" (317)	36" (271)	27" (358)	17" (447)	31" (348)	19" (462)	
2 x 12 @ 8"		48" (136	45" (169)		48" (164)	38" (206)		40" (233)	26" (294)	36" (230)	29" (304)	18" (379)

For SI: 1 in. = 25.4 mm, 1 psf = 0.0479 kN/m²
Notes:
a. Tabulated values are for clear-span roof supported solely by exterior bearing walls.
b. Spans are based on No. 2 Grade lumber of douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (3 or more)

members.

c. Ratio of backspan to cantilever span shall be at least 3:1.

d. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.

e. Uplift force is for a backspan to cantilever span ratio provided (3/backspan ratio).

f. See Section R301.2.2.7.1 for additional limitations on cantilevered floor joists for detached one- and two-family dwellings in Seismic Design Categories D1 and D2 and townhouses in Seismic Design Categories C, D1, and D2.

g. A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilever support.

h. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

CHAPTER 6

WALL CONSTRUCTION

R602.8 Fireblocking required. Fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and the roof space. Fireblocking shall be provided in wood-frame construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces, at the ceiling and floor level and at 10 foot (3048 mm) intervals both vertical and horizontal. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.
2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R314.8.
4. At openings around vents, pipes, wires, ~~and~~ ducts, and any other openings at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion.
5. For the fireblocking of chimneys and fireplaces, see Section R1001.16.
6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

CHAPTER 7

WALL COVERING

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD

THICKNESS OF GYPSUM BOARD (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING
				Nails [a]	Screws [b]	
Application without adhesive						
3/8	Ceiling [d]	Perpendicular	16	7	12	13 gage, 1 1/4" long, 19/64" head; 0.098 diameter, 1 1/4" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 1 3/8" long, 7/32" head.
	Wall	Either direction	16	8	16	
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 3/8" long, 19/64" head; 0.098 diameter, 1 1/4" long, annular-ringed; 5d cooler nail, 0.086 diameter, 1 5/8" long, 15/64' head; or gypsum board nail, 0.086 diameter, 1 5/8" long, 9/32" head.
	Ceiling [d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	15	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 1 5/8" long, 19/64" head; 0.098 diameter, 1 3/8" long, annular-ringed; 6d cooler nail, 0.092 diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915 diameter, 1 7/8" long, 19/64" head.
	Ceiling [e]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
Application with adhesive						
3/8	Ceiling [d]	Perpendicular	16	16	16	Same as above for 3/8" gypsum board
	Wall	Either direction	16	16	24	
½ or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board
	Ceiling [d]	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board; face ply installed with adhesive
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 21/2 inches apart may be used with the pair of nails spaced 12 inches on center.

b. Screws shall be Type S or W per ASTM C 1002 and shall be sufficiently long to penetrate wood framing not less than 5/8 inch and metal

framing not less than 3/8 inch.

c. Where metal framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the gypsum board thickness and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13 ½ gage, 1 5/8 inches long, 15/64-inch head for 1/2-inch gypsum board; and 6d, 13 gage, 17/8 inches long, 15/64-inch head for 5/8-inch gypsum board.

d. Three-eighths-inch-thick single-ply gypsum board shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to ½ inch for 16-inch on center framing, and from ½ inch to 5/8 inch for 24-inch on center framing or 1/2-inch sag-resistant gypsum ceiling board shall be used.

e. Type X gypsum board for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum 6 inch on center by minimum 1 7/8 inch 6d coated nails or equivalent drywall screws.

CHAPTER 8

ROOF-CEILING CONSTRUCTION

R806.2 Minimum area. The total net free ventilating area shall not be less than 1 to 150 of the area of the space ventilated except that the total area is permitted to be reduced to 1 to 300, provided at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. ~~As an alternative, the net free cross-ventilation area may be reduced to 1 to 300 when a vapor barrier having a transmission rate not exceeding 1 perm (57.4 mg/s•m^2•Pa) is installed on the warm side of the ceiling~~.

CHAPTER 9

ROOF ASSEMBLIES

R902.1 Roofing covering materials. Roofs, except for those on residential outbuildings, shall be covered with materials as set forth in Sections R904 and R905. Class A, B or C roofing shall be installed ~~in areas designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a property line~~. Classes A, B and C roofing required to be listed by this section shall be tested in accordance with UL 790 or ASTM E 108. Roof assemblies with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets, and metal sheets and shingles, shall be considered Class A roof coverings.

R903.4.1 Overflow drains and scuppers. Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches (51 mm) above the low point of the roof, or overflow scuppers having three times the size of the roof drains and having a minimum opening height of 4 inches (102 mm) may be installed in the adjacent parapet walls with the inlet flow located 2 inches (51 mm) above the low point of the adjacent roof. The installation and sizing of overflow drains, leaders and conductors shall comply with the ~~*International Plumbing Code*~~ *City of Houston Plumbing Code.*

Overflow drains shall discharge to an approved location and shall not be connected to roof drain lines.

Part V — Mechanical

CHAPTER 12

MECHANICAL ADMINISTRATION

M1201.1 Scope. The provisions of Chapters 12 through 24 shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions within buildings. These chapters shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed in this code. The administrative provisions of the City of Houston Mechanical Code shall govern Chapters 12 through 23 as well as the mechanical provisions of Chapter 24.

~~**SECTION M1202**~~

~~**EXISTING MECHANICAL SYSTEMS**~~

~~**M1202.1 Additions, alterations or repairs.** Additions, alterations, renovations or repairs to a mechanical system shall conform to that required for a new mechanical system without requiring the existing mechanical system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause an existing mechanical system to become unsafe, hazardous or overloaded. Minor additions, alterations or repairs to existing mechanical systems shall meet the provisions for new construction, unless such work is done in the same manner and arrangement as was in the existing system, is not hazardous, and is approved.~~

~~**M1202.2 Existing installations.** Except as otherwise provided for in this code, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing mechanical system lawfully in existence at the time of the adoption of this code.~~

~~**M1202.3 Maintenance.** Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for maintenance of the mechanical systems. To determine compliance with this provision, the building official shall have the authority to require a mechanical system to be reinspected.~~

CHAPTER 13

GENERAL MECHANICAL SYSTEM REQUIREMENTS

M1301.1 Scope. The provisions of this chapter shall govern the installation of mechanical systems not specifically covered in other chapters applicable to mechanical systems. Installations of mechanical appliances, equipment and systems not addressed by this code shall comply with the applicable provisions of the ~~*International*~~ *City of Houston Mechanical Code* and the ~~*International Fuel Gas Code*~~. *City of Houston Plumbing Code.*

M1305.1.3 Appliances in attics. Attics containing appliances requiring access shall be provided with a pull down stairway with a clear opening not less than 22 inches in width and a load capacity of not less than 350 pounds ~~an opening~~ and a clear and unobstructed passageway large enough to allow removal of the largest appliance, but not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring in accordance with Chapter 5 not less than 24 inches (610 mm) wide. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present along all sides of the appliance where access is required. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches (508 mm by 762 mm), where such dimensions are large enough to allow removal of the largest appliance.

~~**M1305.1.3.1 Electrical requirements.** A lighting fixture controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the appliance location in accordance with Chapter 38.~~

M1305.1.4 Appliances under floors. Underfloor spaces containing appliances requiring access

shall be provided with an unobstructed passageway large enough to remove the largest appliance, but not less than 30 inches (762 mm) high and ~~22~~ 30 inches (~~559~~ 762 mm) wide, nor more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the appliance. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending 4 inches (102 mm) above the adjoining grade in accordance with Chapter 4. The rough framed access opening dimensions shall be a minimum of ~~22~~ 30 inches by 30 inches (~~559~~ 762 mm by 762 mm), where the dimensions are large enough to remove the largest appliance.

M1305.1.4.1 Ground clearance. Appliances supported from the ground shall be level and firmly supported on a concrete slab or other approved material extending not less than 3 inches (76 mm) above the adjoining ground. Appliances suspended from the floor shall have a clearance of not less than 6 inches (152 mm) from the ground.

M1307.3.1 Protection from impact. Appliances located in a garage or carport or within 24 inches (608 mm) adjacent to a driveway shall be protected from impact by automobiles.

CHAPTER 14

HEATING AND COOLING EQUIPMENT

M1401.2 Access. Heating and cooling equipment shall be located with respect to building construction and other equipment to permit maintenance, servicing and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustments. A level service space at least 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present along all sides of the appliance where access is required.

M1401.3 ***Reserved.*** ~~**Sizing.** Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.~~

M1405.1 General. Electric baseboard convectors shall be installed in accordance with the manufacturer's installation instructions and ~~Chapters 33 through 42 of this code.~~ the Electrical Code of the City of Houston.

M1406.1 General. Electric radiant heating systems shall be installed in accordance with the manufacturer's installation instructions and ~~Chapters 33 through 42 of this code.~~ the Electrical Code of the City of Houston.

M1407.1 General. Electric duct heaters shall be installed in accordance with the manufacturer's installation instructions and ~~Chapters 33 through 42 of this code.~~ the Electrical Code of the City of Houston. Electric furnaces shall be tested in accordance with UL 1995.

M1407.3 ***Reserved.*** ~~**Installation with heat pumps and air conditioners.** Duct heaters located within 4 feet (1219 mm) of a heat pump or air conditioner shall be listed and labeled for such installations. The heat pump or air conditioner shall additionally be listed and labeled for such duct heater installations.~~

M1407.5 Fan interlock. The fan circuit shall be provided with ~~an interlock~~ safety device to prevent heater operation when the fan is not operating.

M1411.2 Refrigeration coils in warm-air furnaces. ~~Where a cooling coil is located in the supply plenum of a warm-air furnace, the furnace blower shall be rated at not less than 0.5-inch water column (124 Pa) static pressure unless the furnace is listed and labeled for use with a cooling coil.~~ Cooling coils shall not be located upstream from heat exchangers unless listed and labeled for such use. Conversion of existing furnaces for use with cooling coils shall be permitted provided the furnace will operate within the temperature rise specified for the furnace.

M1411.3.1 ~~**Auxiliary and secondary drain systems.** In addition to the requirements of Section M1411.3, a secondary drain or auxiliary drain pan shall be required for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. Drain piping shall be a minimum of 3/4-inch (19.1 mm) nominal pipe size. One of the following methods shall be used:~~

~~1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1.5 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion resistant material. Metallic pans shall have a minimum thickness~~

~~of not less than 0.0276-inch (0.7 mm) galvanized sheet metal. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).~~

~~2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.~~

~~3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water level detection device that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.~~

Condensate wastes. When a cooling coil or cooling unit is located in an attic or furred space where damage may result from condensate overflow, an additional watertight pan of corrosion-resistant metal shall be installed beneath the cooling coil or unit top to catch the overflow condensate caused by a clogged primary condensate drain, or one pan with a standing overflow and a separate secondary drain may be provided with a drain pipe, minimum 3/4-inch (19 mm) nominal pipe size, discharging at a point that can be readily observed.

Exception: The additional watertight pan may be of corrosion resistant material other than metal when approved by the building official.

M1411.3.2 Condensate Waste Sizing. Condensate waste pipe from air-cooling coils shall be sized in accordance with equipment capacity as follows:

EQUIPMENT CAPACITY	MINIMUM CONDENSATE PIPE DIAMETER
Up to 10 tons (70.3kW) of refrigeration	3/4 inch (19 mm)
Over 10 (70.3kW) to 40 tons (141 kW) of refrigeration	1 inch (25 mm)
Over 40 (141 kW) to 90 tons (317 kW) of refrigeration	1 1/4 inch (32 mm)

Over 90 (317 kW) to 125 tons (440 kW) of refrigeration	1 ½ inch (38 mm)
Over 125 (440 kW) to 250 tons (879 kW) of refrigeration	2 inch (51 mm)

The size of condensate waste pipes may be for one unit or a combination of units, or as recommended by the manufacturer. The capacity of waste pipes assumes a 1/8 inch per foot (10.5 mm/m) or one percent slope, with pipe running three-quarters full:

Condensate drain sizing for other slopes or other conditions shall be approved by the building official.

M1411.3.3 Condensate. Condensate from air-cooling coils shall be collected and drained to an approved location. Drain pans and coils shall be arranged to allow thorough drainage and access for cleaning. Primary drain piping inside buildings shall be insulated for the first 15 feet horizontally from the drain pan.

CHAPTER 15

EXHAUST SYSTEMS

M1502.2 Duct material. Single-wall ducts serving range hoods shall be constructed of galvanized steel, stainless steel or copper.

Exception: Ducts for domestic kitchen cooking appliances equipped with down draft exhaust systems shall be permitted to be constructed of schedule 40 PVC pipe provided that the installation complies with all of the following:

1. The duct shall be installed under a concrete slab poured on grade
2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel,
3. The PVC duct shall extend not greater than ~~1 inch (25.4 mm)~~ 6 inches (152.4 mm) above the indoor concrete floor surface,
4. The PVC duct shall extend not greater than ~~1 inch (25.4 mm)~~ 12 inches (304.8 mm) above grade outside of the building, and
5. The PVC ducts shall be solvent cemented.

SECTION M1506

MAKE UP AIR

M1506.1 Make up air. When a closet is designed for the installation of a clothes dryer, a minimum opening of 100 square inches (1.0645 m²) for makeup air shall be provided in the door or by other approved means.

CHAPTER 16

DUCT SYSTEMS

M1601.3.1 Joints and seams. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing or other approved closure systems. Closure systems used with rigid fibrous glass ducts shall comply with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Closure systems used with flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment or sheet metal fittings shall be mechanically fastened. Crimp joints for round ducts shall have a contact lap of at least 1.5 inches (38 mm) and shall be mechanically fastened by means of at least three sheet metal screws or rivets equally spaced around the joint. Sealing shall comply with SMACNA, method "A".

M1601.3.2 Support. Metal ducts shall be supported by ~~0.5~~ 1-inch ~~(12.7 mm)~~ (25.4 mm) wide ~~18-~~24-gage metal straps or 12-gage galvanized wire at intervals not exceeding 10 feet (3048 mm) or other approved means. Nonmetallic ducts shall be supported in accordance with the manufacturer's installation instructions.

~~**M1601.4 Under-floor plenums.** An under-floor space used as a supply plenum shall conform to the requirements of this section. Fuel gas lines and plumbing waste clean-outs shall not be located within the space.~~

~~**M1601.4.1 General.** The space shall be cleaned of loose combustible materials and scrap, and shall be tightly enclosed. The ground surface of the space shall be covered with a moisture barrier having a minimum thickness of 4 mils (0.102 mm).~~

~~**M1601.4.2 Materials.** The under-floor space, including the sidewall insulation, shall be formed by materials having flame-spread ratings not greater than 200 when tested in accordance with ASTM E 84.~~

~~**M1601.4.3**~~ **Furnace connections.** A duct shall extend from the furnace supply outlet to not less than 6 inches (152 mm) below the combustible framing. This duct shall comply with the provisions of Section M1601.1. A noncombustible receptacle shall be installed below any floor opening into the plenum in accordance with the following requirements:

1. The receptacle shall be securely suspended from the floor members and shall not be more than 18 inches (457 mm) below the floor opening.
2. The area of the receptacle shall extend 3 inches (76mm) beyond the opening on all sides.
3. The perimeter of the receptacle shall have a vertical lip at least 1 inch (25.4 mm) high at the open sides.

~~**M1601.4.4 Access.** Access to an under-floor plenum shall be provided through an opening in the floor with minimum dimensions of 18 inches by 24 inches (457mmby 610 mm).~~

~~**M1601.4.5**~~ **M1601.4.1 Furnace controls.** The furnace shall be equipped with an automatic control that will start the air circulating fan when the air in the furnace bonnet reaches a temperature not greater than 150°F (66°C). The furnace shall additionally be equipped with an approved automatic control that limits the outlet air temperature to ~~200~~ 250°F ~~(93°C)~~ (156.67°C).

Part VI — Fuel Gas

CHAPTER 24
FUEL GAS

G2401.1 (101.1) Application. This chapter covers those fuel gas piping systems, fuel gas utilization equipment and related accessories, venting systems and combustion air configurations most commonly encountered in the construction of one and two-family dwellings and structures regulated by this code.

Coverage of piping systems shall extend from the point of delivery to the connections with gas utilization equipment. (See "point of delivery.") Piping systems requirements shall include design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance. Requirements for gas utilization equipment and related accessories shall include installation, combustion, and ventilation air and venting.

The omission from this chapter of any material or method of installation provided for in the ~~*International Fuel Gas Code*~~ *City of Houston Plumbing Code* shall not be construed as prohibiting the use of such material or method of installation. Fuel gas piping systems, fuel gas utilization equipment and related accessories, venting systems and combustion air configurations not specifically covered in these chapters shall comply with the applicable provisions of the ~~*International Fuel Gas Code*~~ *City of Houston Plumbing Code.*

This chapter shall not apply to the following:

1. Liquified natural gas (LNG) installations.
2. Temporary LP-Gas piping for buildings under construction or renovation that is not to become part of the permanent piping system..
3. Except as provided in Section 401.1.1, gas piping, meters, gas pressure regulators, and other appurtenances used by the serving gas supplier in the distribution of gas, ~~other than undiluted LP-Gas~~.

4. The regulations of this chapter shall not be applicable to liquid petroleum gas facilities regulated by the Railroad Commission of Texas pursuant to chapter 113 of the Texas Natural Resources Code.

Note: All fuel oil facilities and piping shall conform to the Article 79 of the City of Houston Fire Code.

~~**G2404.9 (301.14) Rodent proofing.** Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entry of rodents.~~

G2406.2 (303.3) Prohibited locations. Fuel-fired appliances shall not be located in, or obtain combustion air from, any of the following rooms or spaces:

1. Sleeping rooms.
2. Bathrooms.
3. Toilet rooms.
4. Storage closets.

Exceptions:

1. Direct-vent appliances that obtain all combustion air directly from the outdoors.
2. Vented room heaters, wall furnaces, vented decorative appliances and decorative appliances for installation in vented solid fuel-burning fireplaces, provided that the room is not a confined space and the building is not of unusually tight construction.
3. ~~A single listed wall-mounted unvented room heater equipped with an oxygen depletion safety shutoff system and installed in a bathroom provided that the input rating does not exceed 6,000 Btu per hour (1760 W/hr) and the bathroom is not a confined space.~~
4. ~~A single listed wall-mounted unvented room heater equipped with an oxygen depletion safety shutoff system and installed in a bedroom provided that the input rating does not~~

~~exceed 10,000Btu per hour (2930 W/hr) and the bathroom is not a confined space.~~

~~5.~~ Appliances installed in a dedicated enclosure in which all combustion air is taken directly from the outdoors, in accordance with Section G2407.11. Access to such an enclosure shall be through a weather-stripped solid door equipped with an approved self-closing device.

G2407.2 (304.2) ***Reserved.*** ~~**Appliance/equipment location.** Equipment shall be located so as not to interfere with proper circulation of combustion, ventilation and dilution air.~~

G2407.4 (304.4) ***Reserved.*** ~~**Process air.** In addition to air needed for combustion, process air shall be provided as required for cooling of equipment or material, controlling dew point, heating, drying, oxidation, dilution, safety exhaust, odor control, and air for compressors.~~

G2407.5 (304.5) ***Reserved.*** ~~**Ventilation air.** In addition to air needed for combustion, air shall be supplied for ventilation, including all air required for comfort and proper working conditions for personnel.~~

G2407.6 (304.6) Draft head/regulator location. For equipment with atmospheric burners, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the equipment served so as to prevent any difference in pressure between the hood or regulator and the combustion air supply.

G2407.14 (304.14) Louvers and grilles. In calculating free area in Sections G2407.10, G2407.11 and G2407.12, the required size of openings for combustion, ventilation and dilution air shall be based on the net free area of each opening. If the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. If the design and free area are not known, it shall be assumed that wood louvers will have ~~20- to~~ 25-

percent free area and metal louvers and grilles will have ~~60- to 75-~~ 50-percent free area. Louvers and grilles shall be fixed in the open position.

G2407.15 (304.15) Combustion air ducts. Combustion air ducts shall comply with all of the following:

1. Ducts shall be of galvanized steel complying with Chapter 16 of this code or of equivalent corrosion-resistant material approved for this application.

   Exception: Unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.
2. Ducts shall terminate in an unobstructed space allowing free movement of combustion air to the appliances.
3. Ducts shall serve a single enclosure.
4. Ducts shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
5. Ducts shall not be screened where terminating in an attic space.
6. Horizontal upper combustion air ducts shall ~~not~~ slope downward toward the source of combustion air. See Chapter 17.

~~**G2409.3.4 (308.3.5) Plenum clearances.** Where the plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is 2 inches (51 mm) or less.~~

~~**G2409.3.5 (308.3.6) Clearance from supply ducts.** Air conditioning equipment shall have the clearance from supply ducts within 3 feet (914mm)of the plenum be not less than that specified from the plenum. No clearance is necessary beyond this distance.~~

G2409.4.4 (308.4.5) ***Reserved.*** **Plenum clearances.** Where the plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is 2 inches (51 mm) or less.

G2409.4.5 (308.4.6) ***Reserved.*** **Clearance from supply ducts.** Central heating furnaces shall have the clearance from supply ducts within 3 feet (914 mm) of the plenum be not less than that specified from the plenum. No clearance is necessary beyond this distance.

G2409.4.6 (308.4.7) ***Reserved.*** ~~**Unlisted central heating furnaces.** Unlisted central heating furnaces with temperature limit controls that cannot be set higher than 250EF (121EC) shall have the clearance from supply duct with 6 feet (1829 mm) of the plenum be not less than 6 inches (152 mm). No clearance is necessary beyond this distance.~~

~~**G2410.2 (309.2) Connections.** Electrical connections between gas utilization equipment and the building wiring, including the grounding of the equipment, shall conform to Chapters 33 through 42.~~

G2411.1 (401.1) Scope. This chapter shall govern the design, installation, modification and maintenance of gas piping systems. The applicability of this code to piping systems extends from the point of delivery to the connections with the equipment and includes the design, materials, components, fabrication, assembly, installation, testing, inspection, operation and maintenance of such gas piping systems.

G2411.2 (401.2) Liquefied petroleum gas storage. The storage system for liquefied petroleum gas shall be designed and installed in accordance with the ~~*International Fire Code* and NFPA 58.~~ *City of Houston Fire Code* and applicable State laws that are administered by the Texas Railroad Commission.

SECTION G2412 (402)

GAS PIPE SIZING

G2412.3 (402.3) Sizing. ~~Gas piping shall be sized in accordance with Tables G2412.3(1) through G2412.3(6), or other approved engineering methods. (See Appendix A.)~~ Gas piping shall be sized in accordance with tables G2412.3(1) through G2412.3(6). CSST piping shall be sized according to manufacturer's recommendations and the City of Houston Plumbing Code.

~~**G2412.5.1 (402.5.1) Liquefied petroleum gas systems.** The operating pressure for undiluted LP-Gas systems shall not exceed 20 psig (140 kPa gauge). Buildings having systems designed to operate below -5°F (-21°C) or with butane or a propane-butane mix shall be designed to either accommodate liquid LP-Gas or prevent LP-Gas vapor from condensing back into a liquid.~~

G2413.5 (403.5) Metallic tubing. ~~Seamless copper,~~ Aluminum alloy or steel tubing shall be permitted to be used with gases not corrosive to such material.

G2413.5.2 (403.5.2) Copper tubing. ~~Copper tubing shall comply with standard Type K or L of ASTM B 88 or ASTM B 280. Copper and brass tubing shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 standard cubic feet of gas (0.7 milligrams per 100 liters).~~ Copper pipe or tubing shall not be used for gas piping systems.

~~**G2413.6.2 (403.6.2) LP-Gas systems.** The use of plastic pipe, tubing and fittings in undiluted liquefied petroleum gas piping systems shall be in accordance with NFPA 58.~~

G2413.10.4 (403.10.4) Metallic fittings. Metallic fittings, including valves, strainers and filters shall comply with the following:

1. Fittings used with steel or wrought-iron pipe shall be steel, brass, bronze, malleable iron, ductile iron or cast iron.

2. Fittings used with ~~copper or~~ brass pipe shall be ~~copper,~~ brass or bronze.
3. Brass or bronze ~~or copper~~ fittings. Fittings, if exposed to soil, shall have a minimum 80-percent copper content.
4. Special fittings. Fittings such as couplings, proprietary-type joints, saddle tees, gland-type compression fittings, flared, flareless or compression-type tubing fittings shall be permitted to be used provided they are used within the fitting manufacturer's pressure temperature recommendations; used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion or contraction; installed or braced to prevent separation of the joint by gas pressure or external physical damage; and approved.

G2414.3 (404.3) Piping in concealed locations. Portions of a piping system installed in concealed locations shall not have unions, tubing fittings, right and left couplings, bushings, compression ~~Standard for the Storage and Handling of Liquefied Petroleum Gases~~, couplings and swing joints made by combinations of fittings.

Exceptions:

1. Tubing joined by brazing.
2. Fittings listed for use in concealed locations.

G2414.4 (404.4) Piping through foundation wall. Underground piping, where installed below grade through the outer foundation or basement wall of a building, shall be encased in a protective pipe sleeve. The annular space between the gas piping and the sleeve shall be sealed at the point where it enters the building, and the sleeve shall be vented to the outside of the building.

G2414.6 (404.6) Piping in solid floors. Piping in solid floors shall be laid in channels in the floor and covered in a manner that will allow access to the piping with a minimum amount of damage to the building. Where such piping is subject to exposure to excessive moisture or corrosive

substances, the piping shall be protected in an approved manner. As an alternative to installation in channels, the piping shall be installed in a casing of schedule 40 steel, wrought iron, PVC or ABS pipe with tightly sealed ends and joints. Both ends of such casing shall extend not less than 2 inches (51 mm) beyond the point where the pipe emerges from the floor. All channels and sleeves shall be vented.

G2414.8 (404.8) Protection against corrosion. Metallic pipe or tubing exposed to corrosive action, such as soil condition or moisture, shall be protected in an approved manner. Zinc coatings (galvanizing) shall not be deemed adequate protection for gas piping underground. Ferrous metal exposed in exterior locations shall be protected from corrosion in a manner satisfactory to the code official. Where dissimilar metals are joined ~~underground~~, an insulating coupling or fitting shall be used. Piping shall not be laid in contact with cinders.

G2414.8.1 (404.8.1) Prohibited use. Uncoated threaded or socket welded joints shall not be used in piping in contact with soil. ~~or where internal or external crevice corrosion is known to occur.~~

G2414.9.1 (404.9.1) Individual outside appliances. Individual lines to outside lights, grills or other appliances shall be installed a minimum of ~~8~~ 12 inches ~~(203 mm)~~ (304.56 mm) below finished grade, provided that such installation is approved and is installed in locations not susceptible to physical damage.

G2416.1.1 (406.1.1) Inspections. Inspection shall consist of visual examination, during or after manufacture, fabrication, assembly ~~or~~ and pressure tests as appropriate. The building official shall make the following inspections and shall either approve the portion of the work as completed, or shall notify the permit holder that the same fails to comply with this code:

1. Rough Piping Inspection. This inspection shall be made after all gas piping authorized

by the permit has been installed and before any such piping has been covered or concealed, or any fixture or appliance has been attached thereto. This inspection shall include a determination that the gas piping size, material, and installation meet the requirements of this Code. This inspection shall also include a pressure test. The gas piping shall pass an air pressure test of 25 psi for a period of fifteen (15) minutes with no perceptible drop.

Exception: For metal welded piping and for piping carrying gas at pressure in excess of fourteen (14) inches (0.4 m) water column pressure, the test pressure shall not be less that one hundred (100) psi (689 kPa) for thirty (30) minutes. These tests shall be made using air, CO , or nitrogen pressure only and shall be made in the presence of the inspector. All necessary apparatus for conducting tests shall be furnished by the permit holder.

2. Final Piping Inspection. This inspection shall be made after all piping authorized by the permit has been installed and after all portions thereof which are to be covered or concealed are so concealed and after all fixtures, appliances, or shutoff valves have been attached thereto, and after the completed system is ready to be put in service. This inspection shall include an air, CO , or nitrogen pressure test at a pressure of at least six (6) inches (152.4 mm) of mercury, measured with a manometer or slope gauge for a period of not less that fifteen (15) minutes, with no perceptible drop in pressure. The test pressure shall not be less than twice the pressure that the system will be subjected to when in service. These tests shall be made in the presence of an inspector. All necessary apparatus for conducting tests shall be furnished by the permit holder. A final inspection shall be required for all gas systems that require a permit as defined in the City of Houston Plumbing Code.

For annual gas tests and gas turn ons, the tests shall be done at the pressure required for the final gas inspection.

G2416.1.2 (406.1.2) Repairs and additions. ~~In the event repairs or additions are made following the pressure test, the affected piping shall be tested.~~

~~**Exception:** Minor repairs or additions, provided the work is inspected and connections are tested with a non-corrosive leak-detecting fluid or other leak-detecting methods approved by the code official.~~

In cases where the work authorized by the permit consists of a minor installation of additional piping already connected to a gas meter, the foregoing inspections may be waived at the discretion of the building official. In this event, the building official shall make such inspection as deemed advisable in order to be assured the work has been performed in accordance with the intent of this code.

Small sections of piping may be soap tested in the presence of the building official when determined that a complete test is not required to preserve life safety.

G2416.2 (406.2) ***Reserved.*** ~~**Test medium.** The test medium shall be air or an inert gas. Oxygen shall not be used.~~

G2416.4 (406.4) Test pressure measurement. Test pressure shall be measured with a manometer or with ~~a~~ an approved alternative pressure measuring device designed and calibrated to read, record or indicate a pressure loss due to leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made. The following alternative pressure measuring devices are approved:

1. Low Pressure Systems–A low pressure diaphragm gauge with a minimum dial size of 3 ½ inches with a set hand and a pressure range not to exceed six (6) psi with 1/10 pound incrementation. The minimum test pressure shall not be less than three (3) psi and the maximum test pressure to be applied shall not exceed four (4) psi.
2. Medium Pressure Systems–A diaphragm type pressure gauge with a minimum dial size of 3 ½ inches with a set hand and a pressure range not to exceed twenty (20) psi with

2/10 pound incrementation. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psi.

3. High Pressure Systems–Gauges for high pressure test shall be as follows:
   A. Required pressure tests exceeding ten (10) pounds (69 kPa) but less than one hundred (100) pounds (689 kPa) shall be performed with gauges that have one (1) pound (6.9 kPa) incrementation or less.
   B. Required pressure tests exceeding one hundred (100) pounds (689 kPa) shall be performed with gauges incremented for two (2) percent or less of the required test pressure.
   C. Test gauges shall have a pressure range not greater than twice the test pressure applied.

~~**G2416.4.1 (406.4.1) Test pressure.** The test pressure to be used shall be not less than one and one-half times the proposed maximum working pressure, but not less than 3 psig (20 kPa gauge), irrespective of design pressure. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.~~

~~**G2416.4.2 (406.4.2) Test duration.** The test duration shall be not less than 10 minutes.~~

G2417.2 (407.2) Design and installation. Piping shall be supported with pipe hooks, metal pipe straps, bands, brackets or hangers suitable for the size of piping, of adequate strength and quality, and located at intervals so as to prevent or damp out excessive vibration. Piping shall be anchored to prevent undue strains on connected equipment and shall not be supported by other piping or equipment. Pipe hangers and supports shall conform to the requirements of MSS SP-58 and shall be spaced in accordance with Section G2423. Supports, hangers, and anchors shall be installed so as not to interfere with the free expansion and contraction of the piping between anchors. All parts

of the supporting equipment shall be designed and installed so they will not be disengaged by movement of the supported piping.

~~**G2418.4 (408.4) Sediment trap.** Where a sediment trap is not incorporated as a part of the gas utilization equipment, a sediment trap shall be installed as close to the inlet of the equipment as practical. The sediment trap shall be either a tee fitting with a capped nipple in the bottom opening of the run of the tee or other device approved as an effective sediment trap. Illuminating appliances, ranges, clothes dryers, and outdoor grills need not be so equipped.~~

G2422.1 (413.1) General. Service stations for CNG fuel shall be in accordance with this section and the ~~*International*~~ *City of Houston Fire Code.* The operation of CNG service stations shall be regulated by the ~~*International*~~ *City of Houston Fire Code*.

TABLE G2423.1 (415.1)
SUPPORT OF PIPING

STEEL PIPE , NOMINAL SIZE OF PIPE (Inches)	SPACING OF ~~TUBING~~ SUPPORTS (feet)	NOMINAL SIZE ~~SUPPORTS~~ TUBING (inch O.D.)	SPACING OF SUPPORTS (feet)
1/2	6	1/2	4
3/4 or 1	8	5/8 or 3/4	6
1 1/4 or larger (horizontal)	10	7/8 or 1	8
1 1/4 or larger (vertical)	every floor level		

For SI: 1 inch= 25.4 mm, 1 foot = 304.8 mm

G2424.7 ***Reserved.*** ~~**Connection to Fireplace**. Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections G2424.7.1 through G2424.7.3.~~

~~**G2424.7.1 (501.7.1) Closure and access.** A noncombustible seal shall be provided below the~~

~~point of connection to prevent entry of room air into the flue. Means shall be provided for access to the flue for inspection and cleaning.~~

~~**G2424.7.2 (501.7.2) Connection to factory-built fireplace flue.** An appliance shall not be connected to a flue serving a factory-built fireplace unless the appliance is specifically listed for such installation. The connection shall be made in accordance with appliance manufacturer's installation instructions.~~

~~**G2424.7.3 (501.7.3) Connection to masonry fireplace flue**. A connector shall extend from the appliance to the flue serving a masonry fireplace such that the flue gases are exhausted directly into the flue. The connector shall be accessible or removable for inspection and cleaning of both the connector and the flue. Listed direct connection devices shall be installed in accordance with their listing.~~

G2424.8 (501.8) Equipment not required to be vented. The following appliances shall not be required to be vented:

1. Ranges.
2. Built-in domestic cooking units listed and marked for optional venting.
3. Hot plates and laundry stoves.
4. Type 1 Clothes dryers (Type 1 clothes dryers shall be exhausted in accordance with the requirements of ~~Section G2437)~~. Chapter 15)
5. Refrigerators.
6. Counter appliances.
7. Decorative appliances. ~~Room heaters listed for unvented use.~~

~~Where the appliances and equipment listed in Items 1 through 7 above are installed so that the aggregate input rating exceeds 20 Btu per hour per cubic foot (207 watts per m^3) of volume of the room or space in which such appliances and equipment are installed, one or more shall be provided~~

~~with venting systems or other approved means for conveying the vent gases to the outdoor atmosphere so that the aggregate input rating of the remaining unvented appliances and equipment does not exceed the 20 Btu per hour per cubic foot (207 watts per m³) figure. Where the room or space in which the equipment is installed is directly connected to another room or space by a doorway, archway or other opening of comparable size that cannot be closed, the volume of such adjacent room or space shall be permitted to be included in the calculations.~~

G2424.10 (501.10) Connections to exhauster. Appliance connections to a chimney or vent equipped with a power exhauster shall be made on the inlet side of the exhauster. Joints on the positive pressure side of the exhauster shall be sealed to prevent flue-gas leakage as specified by the manufacturer's installation instructions for the exhauster. <u>The sealant needs to have the appropriate temperature rating.</u>

G2426.6.7 (503.6.8) Exterior wall penetrations. A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as ~~provided in Sections G2426.2.4 and G2426.3.4.~~ <u>provided in the manufacturer's instructions.</u>

SECTION G2443 (620)

<u>*RESERVED*</u>

~~UNVENTED ROOM HEATERS~~

~~**G2443.1 (620.1) General.** Unvented room heaters shall be tested in accordance with ANSI Z21.11.2 and shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.~~

~~**G2443.2 (620.2) Prohibited use.** One or more unvented room heaters shall not be used as the sole source of comfort heating in a dwelling unit.~~

~~**G2443.3 (620.3) Input rating.** Unvented room heaters shall not have an input rating in excess of 40,000 Btu/h (11.7 kW).~~

~~**G2443.4 (620.4) Prohibited locations.** The location of unvented room heaters shall comply with Section G2406.2.~~

~~**G2443.5 (620.5) Room or space volume.** The aggregate input rating of all unvented appliances installed in a room or space shall not exceed 20 Btu/h per cubic foot (0.21 kW/m^3) of volume of such room or space. Where the room or space in which the equipment is installed is directly connected to another room or space by a doorway, archway or other opening of comparable size that cannot be closed, the volume of such adjacent room or space shall be permitted to be included in the calculations.~~

~~**G2443.6 (620.6) Oxygen-depletion safety system.** Unvented room heaters shall be equipped with an oxygen-depletion-sensitive safety shutoff system. The system shall shut off the gas supply to the main and pilot burners when the oxygen in the surrounding atmosphere is depleted to the percent concentration specified by the manufacturer, but not lower than 18 percent. The system shall not incorporate field adjustment means capable of changing the set point at which the system acts to shut off the gas supply to the room heater.~~

~~**G2443.7 (620.7)Unvented log heaters.** An unvented log heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.~~

G2445.2 (622.2) ***Reserved.*** ~~**Prohibited location.** Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.~~

G2445.5 (622.5) Electronic ignition. Gas fired cooking appliances with electronic ignition shall not be connected to a ground fault interrupted circuit.

Part VII — Plumbing

CHAPTER 25

PLUMBING ADMINISTRATION

P2502.1 Existing building sewers and drains. Existing building sewers and drains ~~shall~~ may be used in connection with new systems when found by examination and/or test to conform to the requirements prescribed by this document.

CHAPTER 27

PLUMBING FIXTURES

P2701.1 General. Plumbing fixtures, faucets and fixture fittings shall be constructed of approved materials, shall have smooth impervious surfaces, shall be free from defects and concealed fouling surfaces, and except as permitted elsewhere in this code, shall conform to the standards specified in Table P2701.1, and shall be listed or approved by a nationally recognized testing agency. Plumbing fixtures shall be provided with an adequate supply of potable water to flush and keep the fixtures in a clean and sanitary condition without danger of back flow or cross connection.

P2705.1 General. The installation of fixtures shall conform to the following:

1. Floor-outlet or floor-mounted fixtures shall be secured to the drainage connection and to the floor, when so designed, by screws, bolts, washers, nuts and similar fasteners of copper, brass or other corrosion-resistant material.
2. Wall hung fixtures shall be rigidly supported so that strain is not transmitted to the plumbing system.
3. Where fixtures come in contact with walls or floors, the contact area shall be water tight.
4. Plumbing fixtures shall be functionally accessible.
5. The center line of water closets or bidets shall not be less that 15 inches (381 mm) from adjacent walls or partitions or not less than 30 inches (762 mm) center to center forma an adjacent water closet or bidet. There shall be at least 21 inches (533 mm) clearance in front of the water closet, bidet or lavatory to any wall, fixture or door.
6. The location of piping, fixtures or equipment shall not interfere with the operation of windows or doors.

P2708.1 General. Shower compartments shall have at least 900 square inches (0.581 m²) of floor

area and be of sufficient size to inscribe a circle with a diameter not less than 30 inches (762 mm). Hinged shower doors shall open outward. The wall area above built-in tubs having installed shower heads and in-shower compartments shall be constructed ~~as per Section R702.4~~ of materials impervious to water. Such walls shall form a water-tight joint with each other and with either the tub, receptor or shower floor.

Exception: Fold-down seats shall be permitted in the shower, provided the required 900-square-inch (0.581 m^2) dimension is maintained when the seat is in the folded-up position.

~~**P2709.1 Construction.** Shower receptors shall have a finished curb threshold not less than 1 inch (25.4 mm) below the sides and back of the receptor. The curb shall be not less than 2 inches (51 mm) and not more than 9 inches (229 mm) in depth when measured from the top of the curb to the top of the drain. The finished floor shall slope uniformly toward the drain not less than one-fourth unit vertical in 12 units horizontal (2-percent slope) nor more than 0.5 inch (12.7 mm), and floor drains shall be flanged to provide a water-tight joint in the floor.~~

~~**P2709.2 Lining required.** The adjoining walls and floor framing, enclosing on-site built-up shower receptors shall be lined with sheet lead, copper or a plastic liner material that complies with ASTM D 4068. The lining material shall extend not less than 3 inches (76 mm) beyond or around the rough jambs and not less than 3 inches (76 mm) above finished thresholds. Hot mopping shall be permitted in accordance with Section P2709.2.1.~~

~~**P2709.2.1 Hot-mopping.** Shower receptors lined by hot mopping shall be built-up with not less than three layers of standard grade Type 15 asphalt-impregnated roofing felt. The bottom layer shall be fitted to the formed subbase and each succeeding layer thoroughly hot-mopped to that below. All corners shall be carefully fitted and shall be made strong and water tight by folding or lapping, and each corner shall be reinforced with suitable webbing hot-mopped in place. All folds, laps and reinforcing webbing shall extend at least 4 inches (102 mm) in all directions from~~

~~the corner and all webbing shall be of approved type and mesh, producing a tensile strength of not less than 50 pounds per inch (893 kg/m) in either direction.~~

~~**P2709.3 Installation.** Lining materials shall be pitched on-fourth unit vertical in 12 units horizontal (2-percent slope) to weep holes in the subdrain by means of a smooth, solidly formed subbase, shall be properly recessed and fastened to approved backing so as not to occupy the space required for the wall covering, and shall not be nailed or perforated at any point less than 1 inch (25.4 mm) above the finished threshold.~~

~~**P2709.3.1 Materials.** Lead and copper linings shall be insulated from conducting substances other than the connecting drain by 15-pound (6.80 kg) asphalt felt or its equivalent. Sheet lead liners shall weigh not less than 4 pounds per square foot (19.5 kg/m^2). Sheet copper liners shall weigh not less than 12 ounces per square foot (3.82 kg/m^2). Joints in lead and copper pans or liners shall be burned or silver brazed, respectively. Joints in plastic liner materials shall be jointed per the manufacturer's recommendations.~~

~~**P2709.4 Receptor drains.** An approved flanged drain shall be installed with shower subpans or linings. The flange shall be placed flush with the subbase and be equipped with a clamping ring or other devisce to make a water-tight connection between the lining and the drain. The flange shall have weep holes into the drain.~~

P2709.1 Floor drains. Floor drains shall be considered plumbing fixtures, and each such drain shall be provided with an approved type strainer that has a waterway equivalent to the area of the tailpiece. Floor drains, floor receptors, and shower drains shall be an approved type, suitably flanged to provide a watertight joint in the floor.

P2709.2 Shower receptors. Shower receptors are plumbing fixtures and shall conform to the

general requirements therefor contained in section 2701.1. Each such shower receptor shall be constructed of vitrified china or earthenware, ceramic tile, porcelain enameled metal or such other material as may be acceptable to the building official. No shower receptor shall be installed unless it conforms to acceptable standards as referenced in this chapter and listed Table 2701.1 or until a specification or a prototype or both of such receptor has first been submitted to and approved by the building official.

P2709.3 Curb or threshold. Each shower receptor shall be so constructed as to have finished a dam, curb, or threshold that is at least one (1) inch (25.4 mm) lower than the sides and back of such receptor. In no case shall any dam or threshold be less than two (2) inches (50.8 mm) nor more than nine (9) inches (228.6 mm) in depth when measured from the top of the dam or threshold to the top of the dam to the top of the drain. Each such receptor shall be provided with an integral nailing flange to be located where the receptor meets the vertical surface of the finished interior of the shower compartment. The flange shall be watertight and extend vertically a minimum of one (1) inch (25.4 mm) above the top of the sides of the receptor. The finished floor of the receptor shall slope uniformly from the sides toward the drain not less than one-quarter (1/4) inch per foot (20.9 mm/m), nor more than one-half (½) inch per foot (41.8 mm/m). Thresholds shall be of sufficient width to accommodate a minimum twenty two (22) inch (0.6m) door.

Exception: Special use shower compartments for wheelchair use may eliminate the curb or threshold. The required slope and depth shall be maintained from the door entry to the drain opening. The minimum distance between the door or entry to the drain opening shall be four (4) feet (1.2 m).

P2709.4 Minimum interior size. All shower compartments, regardless of shape, shall have a minimum finished interior of one thousand twenty-four (1024) square inches (0.66m²) and shall also be capable of encompassing a thirty (30) inch circle measured at a height equal to the top of the threshold and at a point tangent to its centerline. The minimum area and dimensions shall be

maintained to a point seventy (70) inches (1.8 m) above the shower drain outlet with no protrusions other that the fixture valve or valves, shower head, and safety grab bars or rails.

P2709.5 On-site built-up shower receptors. When the construction of on-site built-up shower receptors is permitted by the building official, one of the following means shall be employed:

1. Shower receptors built directly on the ground:

   Shower receptors built directly on the ground shall be watertight and shall be constructed from approved type dense, non-absorbent and non-corrosive materials. Each such receptor shall be adequately reinforced, shall be provided with an approved flanged floor drain designed to make a watertight joint in the floor, and shall have smooth, impervious, and durable surfaces.

   Shower pans will not be required on the ground floor of buildings with slab-on-grade foundations, provided the shower floor is recessed two (2) inches (50.8 mm) minimum below the finished slab.

   Gang-type institutional showers on the ground floor do not require shower pans if a monolithic curb at least six (6) inches (152 mm) high is poured around the perimeter of the shower. The curb may be eliminated at the entrance to allow for wheelchair use.

2. Shower receptors built above ground:

   When shower receptors are built above ground, the sub-floor and rough side of walls shall be first lined with sheet lead, copper, or other durable and watertight materials to a height of not less than three (3) inches (76.2 mm) above the top of the finished dam or threshold. Lead pans, copper linings, and other approved watertight linings shall be insulated from all conductive substances other than their connecting drain by thirty (30) pound (13.6 kg) asphalt felt or its equivalent, and no lead pan or liner shall be constructed of material weighing less than four (4) pounds per square foot (19.6 kg/m^2). Copper pans or liners shall be at least No. 24 B & S Gauge (0.02 inches) (0.5 mm). Joints in copper pans or liners shall be soldered or brazed. All thirty (30) pound asphalt felt shall be cold mopped to the floor

with an approved asphalt primer. After the felt is in place it shall be coated with primer prior to the installation of the pan or liner.

All lining materials shall be pitched one-quarter (1/4) inch per foot (20.9 mm/m) to weep holes in the subdrain of a smooth and solidly formed subbase. All such lining materials shall extend upward on the on the rough jambs of the shower opening to a point no less than three (3) inches (76.2 mm) above the top of the finished dam or threshold and shall extend outward over the top of the rough threshold over and fastened on the outside face of both the rough threshold and be turned over and fastened on the outside face of both the rough threshold and the jambs.

Non-metallic shower sub-pans or linings may be built-up on the job site of not less than three (3) layers of standard grade thirty (30) pound (13.6 kg) asphalt impregnated roofing felt. The bottom layer shall be fitted to the formed sub-base and each succeeding layer thoroughly hot mopped to that below. All corners shall be carefully fitted and shall be made strong and watertight by folding or lapping, and each corner shall be reinforced with suitable webbing hot-mopped in place. All folds laps, and reinforcing from the corner and all webbing shall be of approved type and mesh, producing a tensile strength of not less than fifty (50) pounds per inch (0.9 kg/mm) in either direction. Non-metallic shower sub pans or linings may also consist of multi-layers of other approved equivalent materials suitably reinforced and carefully fitted in place on the job site as elsewhere required in this section.

Linings shall be properly recessed and fastened to approved backing so as not to occupy the space required for the wall covering and shall not be nailed or perforated at any point which may be less than one (1) inch (25.4 mm) above the finished dam or threshold. An approved type sub-drain shall be installed with every shower sub-pan or lining. Each sub-drain shall be of the type that sets flush with the sub-base and shall be equipped with a clamping ring or other device to make a tight connection between the lining and the drain. The sub-drain shall have weep holes into the waste line.

All shower lining material shall conform to approved standards acceptable to the building

official.

P2709.5.1 Test for shower receptors. Shower receptors shall be tested for watertightness by filling with water to the level of the rough threshold. The test plug shall be so placed that both upper and under sides of the sub-pan shall be subjected to the test at the point where it is clamped to the drain.

P2710.1 Finished. Shower walls shall be finished ~~in accordance with Section R702.4~~ with materials impervious to water.

P2717.3 Sink, dishwasher and food grinder. The combined discharge from a sink, dishwasher, and waste grinder is permitted to discharge through a single 1.5 inch (38 mm) trap. The discharge pipe from the dishwasher shall be increased to a minimum of 0.75 inch (19.1 mm) in diameter ~~and shall connect with a wye fitting between the discharge of the food-waste grinder and the trap inlet or~~ to the head of the food grinder. The dishwasher waste line shall rise and be securely fastened to the underside of the counter before connecting to sink tail piece or food grinder.

CHAPTER 28

WATER HEATERS

P2801.5.1 Pan size and drain. The pan shall be not less than 1.5 inches (38 mm) deep and shall be of sufficient size and shape to receive all dripping and condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a minimum diameter of ~~1~~ .75 inch ~~(25.4 mm~~) (19.05 mm) or the outlet diameter of the relief valve, whichever is larger.

CHAPTER 29

WATER SUPPLY AND DISTRIBUTION

P2902.2.3 ***Reserved.*** ~~**Backflow preventer with intermediate atmospheric vent.** Backflow preventers with intermediate atmospheric vents shall conform to ASSE/ANSI 1012. These devices shall be permitted to be installed where subject to continuous pressure conditions. The relief opening shall discharge by air gap and shall be prevented from being submerged.~~

P2902.4.1 Connections to boilers. The potable supply to the boiler shall be equipped with a reduced pressure principle backflow preventer ~~with an intermediate atmospheric vent complying with ASSE/ANSI 1012. When boilers have conditioning chemicals introduced into the system, the potable water connection shall be protected by a reduced pressure principle backflow preventer~~ complying with ASSE/ANSI 1013.

P2902.4.2 Heat exchangers. Heat exchangers utilizing an essentially toxic transfer fluid shall be separated from the potable water by double-wall construction. An air gap open to the atmosphere shall be provided between the two walls. ~~Heat exchangers utilizing an essentially nontoxic transfer fluid are permitted to be of single-wall construction.~~

~~**Exception:** Heat exchangers utilizing an essentially toxic transfer fluid with a pressure on the transfer fluid side a minimum of 10 psi (69 kPa) lower than the pressure on the potable water side protected with a pressure gradient monitor are permitted to be of single-wall construction~~.

P2902.4.5 Solar systems. The potable water supply to a solar system shall be equipped with a backflow preventer. ~~with intermediate atmospheric vent complying with ASSE/ANSI 1012 or a reduced pressure principle backflow preventer complying with ASSE/ANSI 1013~~. Where

chemicals are utilized, the potable water supply shall be protected by a reduced pressure principle backflow preventer.

P2903.5 Water hammer. The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. ~~A water-hammer arrestor shall be installed where quick-closing valves are utilized, unless otherwise approved. Water hammer arrestors shall be installed in accordance with manufacturer's installation instructions. Water-hammer arrestors shall conform to ASSE/ANSI 1010.~~

~~**TABLE P2904.4.1[a]**~~
~~**WATER SERVICE, SUPPLY AND DISTRIBUTION PIPING**~~

~~MATERIAL~~	~~STANDARD~~
~~ABS plastic pipe (SDR-PR)~~	~~ASTM D 2282~~
~~ABS plastic pipe schedule 40 and 80~~	~~ASTM D 1527~~
~~CPVC plastic hot and cold water distribution systems~~	~~ASTM D 2846~~
~~CPVC plastic pipe schedule 40 and 801~~	~~ASTM F 441~~
~~CPVC plastic pipe schedule (SDR-PR)~~	~~ASTM F 442~~
~~Crosslinked P.E. plastic hot and cold water distribution~~	~~ASTM F 877~~
~~Crosslinked polyethylene (PEX) tubing~~	~~ASTM F 876~~
~~Crosslinked polyethylene/aluminum/crosslinked polybutylene (PEX-AL-PEX) for water service and water distribution piping~~	~~ASTM F 1281~~
~~Ductile iron pressure pipe~~	~~ASTM A 377~~
~~P.B. plastic hot water distribution systems~~	~~ASTM D 3309~~
~~Polybutylene/aluminum/polyethylene (PE-AL-PE) for water service piping~~	~~ASTM F 1282~~
~~Polybutylene (PB) plastic pipe (SDR-PR) based on outside diameter~~	~~ASTM D 3000~~
~~Polybutylene (PB) plastic tubing~~	~~ASTM D 2666~~
~~Polybutylene (PE) plastic tubing~~	~~ASTM D 2737~~
~~Polyethylene (PE) plastic pipe (SDR-PR)~~	~~ASTM D 3000~~
~~Polyethylene (PE) plastic pipe controlled OD~~	~~ASTM D 2447~~
~~Polyethylene plastic pipe, schedule 40~~	~~ASTM D 2104~~
~~Polyethylene plastic pipe (SDR-PR) controlled ID~~	~~ASTM D 2239~~
~~PVC plastic pipe schedule 40, 80 and 120~~	~~ASTM D 1785~~
~~PVC pressure rated pipe (SDR Series)~~	~~ASTM D 2241~~

~~Seamless brass type~~	~~ASTM B 135~~
~~Seamless copper tube~~	~~ASTM B 75~~
~~Seamless copper watertube Type K, L and M~~	~~ASTM B 88~~
~~Seamless red brass pipe, standard sizes~~	~~ASTM B 43~~
~~Specification for polybutylene (PB) plastic pipe (SIDR-PR) based on controlled inside diameter~~	~~ASTM D 2662~~
~~Welded copper water tube (WK, WL, WM) ASTM B 447~~	~~ASTM B 447~~

~~a. Please note that Table P2904.4.1 includes standards for materials for use with cold water only.~~

TABLE P2904.4.1
WATER SERVICE PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 1527; ASTM D 2282
Asbestos-cement pipe	ASTM C 296
Brass pipe	ASTM B 43
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D 2846; ASTM F 441; ASTM F 442; CSA B 137.6
Ductile iron water pipe	AWWA C151; AWWA C115
Galvanized steel pipe	ASTM A 53
Polybutylene (PB) plastic pipe and tubing	ASTM D 2662; ASTM D 2666; ASTM D 3309; CSA B137.8
Polyethylene (PE) plastic pipe	ASTM D 2239; CAN/CSA-B137.1
Polyethylene (PE) plastic tubing	ASTM D 2737
Cross linked polyethylene (PEX) plastic tubing	ASTM F 876; ASTM F 877; CSA CAN/CSA-B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; CSA CAN/CSA-B137.10
Polyethylene/aluminum/polyethylene (PE-AL-PE) pipe	ASTM F 1282; CSA CAN/CSA-B137.9
Polyvinyl chloride (PVC) plastic pipe	ASTM D 1785; ASTM D 2241; ASTM D 2672; CSACAN/CSA B137.3

TABLE P2904.5
WATER DISTRIBUTION PIPE

MATERIAL	STANDARD
Brass Pipe	ASTM B 43

Chlorinated polyvinyl chloride (CPVC) plastic pipe and tubing	ASTM D 2846; ASTM F 441; ASTM F 442; CSA B137.6
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F 877; CSA CAN/CSA-B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; CSA CAN/CSA-B137.10
Galvanized steel pipe	ASTM A 53
Polybutylene (PB) plastic pipe and tubing	ASTM D 3309; CSA CAN3-B137.8

~~TABLE P2904.6~~
~~PIPE FITTINGS~~

~~MATERIAL~~	~~STANDARD~~
~~ABS plastic fittings, schedule 40~~	~~ASTM D 2468~~
~~Butt heat fusion P.E. fittings for plastic pipe and fittings~~	~~ASTM D 3261~~
~~Cast copper alloy solder-joint pressure fittings~~	~~ASME B 16.18~~
~~Metal insert fittings for P. B. tubing~~	~~ASTM F 1380~~
~~Metal insert fittings utilizing a copper crimp ring SDR9 (PEX) tubing~~	~~ASTM F 1807~~
~~Plastic insert fittings for P. B. tubing~~	~~ASTM F 845~~
~~Plastic insert fittings for P.E plastic pipe~~	~~ASTM D 2609~~
~~PVC plastic pipe fitting, schedule 40~~	~~ASTM D 2466~~
~~Socket bell for PVC plastic pipe~~	~~ASTM D 2672~~
~~Socket Type CPVC plastic pipe fittings, schedule 40~~	~~ASTM F 438~~
~~Socket Type CPVC plastic pipe fittings, schedule 80~~	~~ASTM F 439~~
~~Socket Type PVC plastic pipe fittings sch. 80~~	~~ASTM D 2467~~

TABLE P2904.6
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic	ASTM D 2468
Butt Heat Fusion P.E. fittings for plastic pipe	ASTM D 3261
Cast-iron	ASME BB16.4; ASME B16.12
Chlorinated polyvinyl chloride (CPVC) plastic	ASTM F 437: ASTM F 438; ASTM F 439
Copper or copper alloy	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29; ASME B16.32

Gray iron and ductile iron	AWWA C110; AWWA C153
Malleable iron	ASME B16.3
Metal Inset Fittings for P.B. Tubing	ASTM F 845
Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 (PEX) Tubing	ASTM F 1807
Plastic Insert Fittings for P.B. Tubing	ASTM F 845
Polyethylene (PE) plastic	ASTM D 2609
Polyvinyl chloride (PVC) plastic	ASTM D 2464; ASTM D 2466; ASTM D 2467; CSA CAN/CSA-B137.2
Socket Bell for PVC Plastic Pipe	ASTM D 2672
Steel	ASME B16.9; ASME B16.11; ASME B16.28

P2904.12 Underground joints. Joints in polybutylene (PB) plastic pipe or tubing underground ~~or under a concrete floor slab~~ shall be installed using heat fusion, in accordance with the manufacturer's installation instructions. Joints in copper pipe or tube installed in a concrete floor slab or ~~under a concrete floor slab on grade~~ shall be installed using wrought-copper fittings and brazed joints. No joints shall be permitted under slabs.

P2904.14.2 Plastic pipe or tubing to other piping material. Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint. Plastic adapter fittings shall be male only.

CHAPTER 30

SANITARY DRAINAGE

~~**P3001.2 Protection from freezing.** No portion of the above grade DWV system other than vent terminals shall be located outside of a building, in attics or crawl spaces, concealed in outside walls, or in any other place subjected to freezing temperatures unless adequate provision is made to protect them from freezing by insulation or heat or both, except in localities having a winter design temperature above 32ºF (0ºC) (ASHRAE 97.5 percent column, winter, see Chapter 3).~~

P3002.3.1 Drainage. Drainage fittings shall have a smooth interior waterway of the same diameter as the piping served. All fittings shall conform to the type of pipe used. Drainage fittings shall have no ledges, shoulders or reductions which can retard or obstruct drainage flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type, ~~black~~ cast iron or galvanized. Drainage fittings shall be designed to maintain one-fourth unit vertical in 12 units horizontal (2-percent slope) grade.

TABLE P3005.1
FITTINGS FOR CHANGE IN DIRECTION

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	Horizontal to vertical[c]	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	~~X~~[a]	~~X~~[a]
Short Sweep	X	X[a,b]	X[a]
Long sweep	X	X	X
Sanitary tee	X[c]		
Wye	X	X	X
Combination wye and eighth bend	X	X	X

For SI: 1 inch = 25.4 mm.

[a] The fittings shall only be permitted for a 2-inch or smaller fixture drain

[b] Three inches and larger.

[c] For a limitation on multiple connection fittings, see Section P3005.1.1.

P3005.4.1 Fixture branch and stack sizing.

1. Branches and stacks shall be sized according to Table P3005.4.1. Below grade drain pipes shall not be less than ~~1 ½ inches (38 mm)~~ 2 inches (50.66 mm) in diameter.
2. Minimum stack size. Drain stacks shall not be smaller than the largest horizontal branch connected, with the following exceptions:

   2.1. A 4-inch-by-3-inch (102 mm by 76 mm) closet bend or flange or a 4-inch (102 mm) closet bend into a 3-inch (76 mm) stack tee shall be acceptable (see Section P3005.1.4).

CHAPTER 31

VENTS

P3103.1 Roof extension. All open vent pipes which extend through a roof must be 6 inches above the roof. ~~shall be terminated at least [number] inches above the roof or [number] inches above the anticipated snow accumulation, except that where a roof is to be used for any purpose other than weather protection, the vent extensions shall be run at least 7 feet (2134 mm) above the roof.~~

P3114.3 Where permitted. Individual vents~~, branch vents, circuit vents and stack vents~~ shall be permitted to terminate with a connection to an air admittance valve.

P3114.4 Location. The air admittance valve shall be located ~~a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed a minimum of 6 inches (152 mm) above insulation materials where installed in attics.~~ 6 inches above floor level rim of fixture.

CHAPTER 32

TRAPS

TABLE P3201.7
SIZE OF TRAPS AND TRAP ARMS FOR PLUMBING FIXTURES

PLUMBING FIXTURE	TRAP SIZE MINIMUM (inches)
Bathtub (with or without shower head and/or whirlpool attachments)	~~1 ½~~ 2
Bidet	1 1/4
Clothes washer standpipe	2
Dishwasher (on a separate trap)	1 ½
Floor drain	2
Kitchen sink (one or two traps, with or without dishwasher and garbage grinder)	1 ½
Laundry tub (one or more compartments)	1 ½
Lavatory	1 1/4
Shower	1 1/4
Water Closet	~~1~~ 3

For SI: 1 inch = 25.4 mm
NOTE: Consult fixture standards for trap dimensions of specific bowls

This appendix is a direct excerpt from the 2000 *International Fuel Gas Code* and no attempt has been made to coordinate with Chapter 24 of the *International Residential Code*.

APPENDIX A (IFGS)
SIZING AND CAPACITIES OF GAS PIPING

~~(This Appendix is informative and is not part of the Code.)~~

This appendix is a direct excerpt from the 2000 *International Fuel Gas Code* and no attempt has been made to coordinate with Chapter 24 of the *International Residential Code*.

APPENDIX B (IFGS)
SIZING OF VENTING SYSTEMS SERVING APPLIANCES EQUIPPED WITH DRAFT HOODS, CATEGORY I APPLIANCES, AND APPLIANCES LISTED FOR USE AND TYPE B VENTS

~~(This Appendix is informative and is not part of the Code.)~~

This appendix is a direct excerpt from the 2000 *International Fuel Gas Code* and no attempt has been made to coordinate with Chapter 24 of the *International Residential Code*.

APPENDIX C (IFGS)
EXIT TERMINALS OF MECHANICAL DRAFT AND DIRECT-VENT VENTING SYSTEMS

~~(This Appendix is informative and is not part of the Code.)~~

APPENDIX L
CONVENTIONAL LIGHT-FRAME WOOD CONSTRUCTION FOR HIGH-WIND AREAS

SECTION AL101

GENERAL

AL101.1 Scope. This chapter applies to regular-shaped buildings that are not more than three stories in height and are of conventional light-frame construction.

EXCEPTION: Detached carports and garages not exceeding 700 square feet (65 m^2) and

accessory to Group R, Division 3 Occupancies need only comply with the roof-member-to-wall-tie requirements of Section AL103.8.

SECTION AL102
DEFINITION

CORROSION RESISTANT or NONCORROSIVE is material having a corrosion resistance equal to or greater than a hot-dipped galvanized coating of 1.5 ounces of zinc per square foot of surface area. When an element is required to be corrosion resistant or noncorrosive, all of its parts, such as screws, nails, wire, dowels, bolts, nuts, washers, shims, anchors, ties and attachments, shall also be corrosion resistant or noncorrosive.

SECTION AL103
COMPLETE LOAD PATH AND UPLIFT TIES

AL103.1 General. Blocking, bridging, straps, approved framing anchors or mechanical fasteners shall be installed to provide continuous ties from the roof to the foundation system.

Tie straps shall be 1 1/8-inch (28.6 mm) by 0.036-inch (0.91 mm) (No. 20 gage) sheet steel and shall be corrosion resistant as herein specified. All metal connectors and fasteners used in exposed locations or in areas otherwise subject to corrosion shall be of corrosion-resistant or noncorrosive material.

The number of common nails specified is the total required and shall be equally divided on each side of the connection. Nails shall be spaced to avoid splitting of the wood.

EXCEPTION: Pre-manufactured connectors that provide equal or greater tie-down capacity may be used provided that they comply with all the manufacturer's specifications.

AL103.2 Wall-to-foundation tie. Exterior walls shall be tied to a continuous foundation system,

or an elevated foundation system in accordance with Section AL105.

AL103.3 Sills and foundation tie. Foundation plates resting on concrete or masonry foundations shall be bolted to the foundation with not less than1/2-inch-diameter (13mm) anchor bolts with 7-inch-minimum (178 mm) embedment into the foundation and spaced not more than 6 feet (1829 mm) on center.

AL103.4 Floor-to-foundation tie. The lowest-level exterior wall studs shall be connected to the foundation sill plate or an approved elevated foundation system with bent tie straps spaced not more than 48 inches (1219 mm) on center. Tie straps shall be nailed with a minimum of 4 ten penny nails.

AL103.5 Wall framing details. The spacing of studs in exterior walls shall be in accordance with Chapter 6.

Mechanical fasteners complying with this chapter shall be installed at a maximum of 48 inches (1219 mm) on center as required to connect studs to the sole plates, foundation sill plate and top plates of the wall. The fasteners shall be nailed with a minimum of 8 eight penny nails.

Where openings exceed 4 feet (1219 mm) in width, the required tie straps shall be at each edge of the opening and connected to a doubled full-height wall stud. When openings exceed 12 feet (3658 mm) in width, two ties at each connection or a manufactured fastener designed to prevent uplift shall be provided.

AL103.6 Wall sheathing. All exterior walls and required interior main cross-stud partitions shall be sheathed in accordance with Chapter 7.

AL103.7 Floor-to-floor tie. Upper-level exterior wall studs shall be aligned and connected to the wall studs below with tie straps placed a minimum of 48 inches (1219) on center and connected with a minimum of 6 eight penny nails per strap.

AL103.8 Roof-members-to-wall tie. Tie straps shall be provided from the side of the roof-framing member to the supporting members below the roof. Tie straps shall be placed no further apart than every other roof-framing member and connected with a minimum of 8 eight penny nails.

AL103.9 Ridge ties. Opposing common rafters shall be aligned at the ridge and be connected at the rafters with tie straps spaced a maximum of 4 feet (1219 mm) on center and connected with 8 eight penny nails.

AL103.10 Gable-end walls. Gable-end wall studs shall be continuous between points of lateral support which are perpendicular to the plane of the wall. Gable-end wall studs shall be attached with approved mechanical fasteners at the top and bottom. Eight 8 penny nails shall be required for each fastener. Fasteners shall be spaced a maximum of 48 inches (1219 mm) on center.

SECTION AL104

ROOFS

AL104.1 Roof sheathing. Solid roof sheathing shall be applied and shall consist of a minimum 1-inch-thick (25.4 mm) nominal lumber applied diagonally or a minimum 15/32-inch-thick (11.9 mm) wood structural panel or particle board (OSB) or other approved sheathing applied with the long dimension perpendicular to supporting rafters. Sheathing shall be nailed to roof framing in an approved manner. The end joints of wood structural panels or particle board shall be staggered and shall occur over blocking, rafters or other supports.

AL104.2 Roof covering. Roof coverings shall be approved and shall be installed and fastened in accordance with Chapter 9 and with the manufacturer's instructions.

AL104.3 Roof overhang. The roof eave overhang shall not exceed 3 feet (914 mm) unless an analysis is provided showing that the required resistance is provided to prevent uplift.

The roof overhang at gabled ends shall not exceed 2 feet (610 mm) unless an analysis showing that the required resistance to prevent uplift is provided.

SECTION AL105
ELEVATED FOUNDATION

AL105.1 General. When approved, elevated foundations supporting not more than one story and meeting the provisions of this section may be used. A foundation investigation may be required by the building official.

AL105.2 Material. All exposed wood-framing members shall be treated wood. All metal connectors and fasteners used in exposed locations shall be corrosion-resistant or noncorrosive steel.

AL105.3 Wood piles. The spacing of wood piles shall not exceed 8 feet (2438 mm) on center. Square piles shall not be less than 10 inches (254 mm) and tapered piles shall have a tip of not less than 8 inches (203 mm). Eight-inch-square (51613 mm^2) piles shall have a minimum embedment length of 5 feet (1524 mm) and shall project not more than 8 feet (2438 mm) above undisturbed ground surface. Eight-inch (203 mm) taper piles shall have a minimum embedment length of 6 feet (1828 mm) and shall project not more than 7 feet (2134 mm) above undisturbed ground surface.

AL105.4 Girders. Floor girders shall be solid sawn timber, built- up 2-inch-thick (51 mm) lumber or trusses. Splices shall occur over wood piles. The floor girders shall span in the direction parallel to the potential floodwater and wave action.

AL105.5 Connections. Wood piles may be notched to provide a shelf for supporting the floor girders. The total notching shall not exceed 50 percent of the pile cross section. Approved bolted connections with 1/4-inch (6.4 mm) corrosion-resistant or noncorrosive steel plates and 3/4-inch-

diameter (19 mm) bolts shall be provided. Each end of the girder shall be connected to the piles using a minimum of two 3/4-inch-diameter (19 mm) bolts.